

PHEBUS: Probing of Hermean Exosphere by Ultraviolet Spectroscopy: A FUV-EUV Spectrometer for the MPO BepiColombo Mission

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PHEBUS is a dual FUV-EUV spectrometer working in the wavelength range from 55 to 315 nm and devoted to the characterisation of Mercury's exosphere composition and dynamics. Two gratings and two detectors are used according to a special, innovative, compact design. A one degree-of freedom scanning system allows probing, at the highest possible signal to noise ratio, selected regions and altitude ranges of interest. PHEBUS will also search for surface ice layers in permanently shadowed regions of high-latitude craters by interplanetary Ly- α reflectance photometry. A consortium composed of three main partners implements it. Tohoku University (Japan) will provide the detectors and the main entrance mirror, IKI (Russia) will implement the scanning system, and SA/IPSL (France) will take in charge the design, assembly/ test/ integration, and will also provide three small detectors (zero order monitor, Ca and K channels).

PHEBUS will address the following main scientific objectives relative to Mercury's exosphere: (i) composition and vertical structure, (ii) dynamics: day to night circulation, active to inactive regions, (iii) surface release processes, sources: e.g. regolith, meteorites, etc., (iv) search for ionosphere and its relation with neutral atmosphere, (v) exosphere/magnetosphere exchange and transport processes, (vi) escape, source/sink balance, geochemical cycles. More specific objectives, not be addressed by any other mission, are search for ions and noble gases, and for surface ice signature. An important objective of PHEBUS, synergistically with surface-probing instruments of MPO, is to understand the way the regolith of Mercury is affected by erosion processes, through measurements of erosion products in the exosphere, and how these processes modify its chemical and mineralogical composition.

PHEBUS has several significant advantages, in terms of science return, on the MESSENGER UVVS instrument. The extension of the spectral range from 110 nm down to 55 nm provides the capability of observing noble gases, like Ar or Ne, and interesting ions, like OII and possibly HeII (and NaII) at second order. Using a scanning system allows to improve geographical/ latitudinal coverage, vertical sampling and trace species detection capability. Simultaneous and complementary measurements made by MPO and MMO are expected to provide a complete picture of exosphere- magnetosphere interaction. Thanks to its scanning system, PHEBUS will also have the capability to search for surface ice layers in permanently shadowed regions of polar regions.

PS17 Science and Exploration of Mercury